BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1: SUMAS ENERGY 2 GENERATION FACILITY	EXHIBIT ____ (MFL-T) PRE-FILED TESTIMONY OF MICHAEL LEPAGE

Q. Please introduce yourself.

A. My name is Michael Lepage. I am a Certified Consulting Meteorologist and Project Director with Rowan Williams Davies & Irwin Inc., with 20 years of experience on air quality issues. Currently, I am involved in air quality modeling for two proposed 800 MW gas turbine power plants in Ontario. I have previously overseen air modeling studies for other gas turbine plants in Ontario and one in Bangladesh. I have also overseen air modeling and baseline monitoring programs for proposed engine-driven power plants (100 to 200 MW) in Ecuador, Kenya, Vietnam, Pakistan and Bangladesh, and I have been involved in miscellaneous air modeling studies for coal-fired power plants.

Over the past three years, I have headed up a regional air quality modeling effort for the Lower Fraser Valley, to predict ground-level ozone and other pollutants during summertime smog events. The project was sponsored by Health Canada as part of their ongoing research on the effects of alternative passenger vehicles on air quality and human health in the Valley. Over the same time period, I headed up a regional air quality modeling research program in Eastern Canada, which included studies focused on existing and proposed power plants in the region, and participated in a major regional modeling study for Southern China. My background is described further in my curriculum vitae. Exhibit ____ (MFL-1).

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

Q. What is the subject of your pre-filed testimony?

A. My testimony deals with the air quality modeling that was performed by MFG to assess the air quality impact of the Sumas 2 project, and the effect of the changes made in the most recent EFSEC application. Specifically, I will discuss the following issues:

- ! effect of the changes on short-term peak pollutant emissions;
- ! effect of the changes on annual average pollutant emissions;
- ! effect of the changes on ground-level ozone;
- ! effect of the changes on regional haze and visibility;
- ! effect of the changes on particulate matter.

Q. What work have you undertaken to address these issues?

A. I have reviewed the following documents:

- ! Section 6.1, Sumas2 Generation Facility EFSEC Application 99-1, Second Revised Application, June, 2001;
- ! EFSEC Council Order No. 754;
- ! Sumas Energy 2 Generation Facility Air Quality Issue Summary, LFVAQCC, September, 2000;
- ! The Draft Supplemental EIS, EFSEC (by Jones & Stokes), September, 2001;
- ! A numerical simulation of impacts on ground-level ozone concentrations from the proposed Sumas Energy 2, Inc. power generation facility, by C. di Cenzo and J. Pottier of Environment Canada, January, 2000, revised in April, 2001;
- ! Applicant=s Prefiled Testimony, Eric Hansen.

Q. Can you summarize your conclusions based on this review?

A. Yes. My testimony can be summarized as follows:

- ! Ignoring higher emissions due to start-up and shut-down, reductions in annual average concentrations due to the changes in the proposed power plant will generally be small. The total annual emission of all pollutants is about 16% lower than previously considered by EFSEC (due in large part to reductions in

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

ammonia). In the case of the two pollutants that were most discussed last time, PM_{10} and NO_X, the annual emissions will be reduced by only six percent and seven percent respectively. A further reduction of about 10% in maximum ground-level concentrations is added to this, due to the increased stack height, but the overall reduction in concentration remains small. In the case of SO_2, annual emissions will actually increase by 50%.

When higher emissions and higher ground-level concentrations during start-ups and shut-downs are factored in, the annual average concentrations of NO_X, VOC=s and CO may actually be substantially higher than predicted, and may even be higher than described in the prior application.

! With backup oil firing eliminated, the maximum short-term emission will be associated with start-ups and shut-downs. The Second Revised Application (and the Applicant=s Pre-Filed Testimony) fails to analyze the peak emissions from start-ups and shut-downs. For some pollutants (NO_x, CO and VOC=s), the maximum short-term emissions will not be reduced to the extent indicated in the application, and may even be higher than those previously considered by EFSEC.

! The changes to the proposed power plant have only a small effect (no more than a 10% reduction) on the previously predicted ground-level ozone concentrations. However, if start-ups were to occur in the daytime during smog events, they could lead to a significant increase in the predicted maximum 1-hour ozone concentrations.

! The effect of the proposed changes on predicted maximum ground-level concentrations of particulate matter cannot be fully determined, because the Applicant=s analysis does not fully account for the creation of particulate matter after the plume leaves the stack (so-called secondary formation), and does not account for the effect that higher emissions during start-up will have on the secondary formation.

! By itself, the elimination of backup oil firing leads to a small reduction in potential impacts to visibility in the Abbotsford area. This reduction, however, is offset by shortcomings in the modeling used for this analysis, larger SO_2 emissions than previously forecast, and the possible effects of higher NO_X and VOC emissions and higher ground-level concentrations during start-ups and shut-downs. Overall, when comparing the real visibility effects of this application to those presented in the previous application, it is impossible to conclude that there will be a noticeable benefit to visibility.

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

Q: In Order No. 754 at page 23, the Council concluded that with diesel backup, the proposed power plant would emit "too much pollution into an already polluted, sensitive, highly populated, and physically constrained airshed.@ As a result of the changes in the project identified in the Second Revised Application, what impact will there be on the amount of pollution emitted into this airshed?

01 The following table provides a comparison of the annual emissions that were considered by EFSEC previously and those that are presented in the current application:

	Order No. 754 (Tons/Year)	Current Application (Tons/Year)	Percentage Change
NO_X	156	144.5	-7
CO	106	88	-17
SO_2	45	69	+50
VOC	156	153	-2
PM10	223	209	-6
NH_3	279	139	-50
H_2SO_4	9.3	14.3	+50
TOTAL	974	817	-16

Q: Does the table of annual emissions you just presented take into account the peak emissions that occur during start-up and shut-down?

A: No. During start-up and shut-down, emissions of NO_X, CO, VOC=s are significantly higher. The annual emission projections in the application are based on continuous operation, and do not take start-ups and shut-downs into account.

Q: How much difference does it make if the different emission rates during start-up and shut-down are taken into account?

A: It has a big impact on short-term peak emissions, and a smaller impact on the annual emissions shown above. The magnitude of the impact depends on the details of the start-up cycle, the annual number of start-ups and shut-downs and the overall operating time of the plant. Using realistic assumptions that I will detail later, I estimate that annual VOC emissions are about 1.75 times greater than those based on continuous operations (i.e., 268 tons/year instead of 153 tons/year). Annual CO emissions are about 10% greater (97 tons/year instead of 88 tons/year). Annual NO_X emissions, on

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

the other hand, are reduced by about 10%, and emissions of other pollutants would be reduced by 10 to 15%. The overall annual emission of all pollutants would be about 860 tons/year instead of 817, or only 12% lower than that previously considered by the Council.

Q: Are there any other differences during these transition periods that affect the air quality analysis?

A: Yes. In addition to different emission rates, the plume height tends to be lower during start-up and shut-down. A lower plume height means higher ground-level concentrations of all pollutants, which adds to the effect of the increased emissions. Again the magnitude of this effect is related to the details of the start-up cycle, which are not provided in the application nor in the Applicant=s pre-filed testimony.

Q: How about the overall impact. Taking into account both the elimination of diesel and the differences in emission rates and dispersion patterns during these transition periods, would you expect the annual pollutant concentrations due to the facility to be more or less than predicted in the former application?

A: Taking account of all these factors, the maximum annual average pollutant concentrations for at least NO_X, VOC=s and CO could be equal or higher than those presented in the former application. Annual average concentrations of SO_2 will also be higher, due to the higher estimate of sulphur levels in the natural gas in the current Application.

Q: You mentioned before that you would explain later how you estimated the effect of transition periods (start-up and shut-down) on the annual emissions. Would you explain that now, please?

A: Order No. 754 indicated that the proposed PSD air emissions permit allows for up to 200 start-ups and shut-downs per year and that there are potentially 1200 hours/year of emissions that are not accounted for in the total emissions. This is more than triple the number of hours of operation on diesel oil that was assumed in the previous application for the worst-case year (15 days or 360 hours), and about 5 times the amount of diesel operation taking into account the applicant=s prior commitment to limit it to 10 days per year (rolling average).

The information I have seen for gas turbine power plants in Ontario indicates that VOC emissions during start-ups and shut-downs could average 10 times higher, and peak CO emissions could average 3 times higher than during normal operations. The peak 1-hour VOC emission could be 20 times higher, and the peak 1-hour CO emission

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

could be 5 times higher than during normal operations. For one of the pollutants of greatest concern here, NO_X, the emission rate during these transition periods averages about the same as normal operations, but the peak 1-hour emission can be 40% higher. Each start-up cycle spans a period of 3 hours and each shut-down cycle spans 1 hour.

Using this information and the total number of start-ups and shut-downs requested by the applicant in its prior submissions to EFSEC (200 days/year), I forecasted the effect that these transition periods will have on annual emissions. I assumed that, on 200 days/year, the plant begins shutting down at the end of the peak demand period (around 11:00 PM), is off for about 4 hours, goes through a 3 hour start-up period, and then is fully operational throughout the peak demand period (from about 7:00 AM to 11:00 PM). For the remaining 165 days, I made the same assumption that the applicant made for 365 days, i.e., that the plant operates continuously at full load.

Q: SE2's Application and Pre-Filed Testimony highlights much higher percentage reductions in various emissions than what you have shown in your table. What is the basis for those claims?

A: SE2 focuses on reductions in short-term (peak) emissions which, under the backup oil firing option, would have been allowed to occur on 10 days per year maximum, on average. Therefore, while peak short-term emissions may drop significantly, the emissions over the entire year decrease by only a small amount.

Previously, the peak emissions were presented as being associated with the plant=s burning of diesel fuel under full load. In fact, the real peak emissions for some of the pollutants would have been associated with burning of diesel fuel during start-up and shut-down. Experience with other gas turbine power plants equipped with catalytic emission controls suggests that maximum short-term emissions are not associated with full load but, instead, are associated with start-up conditions when the turbines and the emission control devices are not yet fully warmed up. The air quality impacts associated with start-up and shut-down emissions have not been addressed in the application.

Under the current proposal, the peak emissions will be associated with burning natural gas during start-up and shut-down. As I mentioned earlier, my experience with start-ups for proposed gas turbine plants in Ontario has been that VOC emissions peak at a rate up to 20 times higher, CO emissions peak at a rate five times higher, and NO_X emissions peak at a rate 1.4 times higher than during normal full load operations. As a result, maximum short-term emissions of CO and VOC will be significantly higher than those previously considered by the Council, under oil firing at full load. Maximum short-term emission of NO_X would remain lower than previously considered, but not as much lower as indicated in the Second Revised Application.

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

With the lower plume rise during start-up, the maximum short-term, ground-level concentrations of NO_X, CO, and VOC=s could all be much higher than previously considered by the Council.

Q: Do you have any other concern with the way in which the Applicant has presented its claim of reduced emissions?

A: Yes. SE2 claims a 33 percent reduction in NO_X emissions when burning natural gas, but really there is no reduction at all. In making that statement, I am assuming that the point of comparison is the project considered by EFSEC in its Order No. 754. In that order, EFSEC considers a facility that would be emitting NO_X at the rate of two parts per million. As the Council described it: AThe Applicant has proposed to use Selective Catalytic Reduction (SCR) as an emissions reduction technology. With the use of SCR, the NO_X emissions would be reduced to two parts per million by dry volume (ppmdv)@ when burning natural gas. Order No. 754 at 49 (Finding of Fact No. 31). In the Second Revised Application on page 6.1-1, the NO_X emissions when burning natural gas will be exactly the same--two parts per million by dry volume. There is no reduction in NO_X emissions when burning natural gas, yet the applicant on that same page is claiming a 33 percent reduction in NO_X emissions when burning natural gas.

Q: Do you have an understanding of the basis for the applicant=s assertion that there is a reduction in NO_X emissions even though they are the same in the current proposal as in the proposal that was considered by the Council in Order No. 754?

A: Yes. Rather than comparing the current proposal to the proposal that was before EFSEC in Order No. 754, the Applicant has compared the current proposal with an earlier version of the project. In its initial Application to EFSEC in 1999, the Applicant proposed a project that would have had NO_X emissions at the rate of 3.5 parts per million. Later, the Applicant proposed a 3.0 emission rate. Later still, but prior to EFSEC=s Order No. 754, the Applicant had proposed to reduce that to two parts per million. My understanding is that we are supposed to be comparing the current project with the project that was before EFSEC at the time Order No. 754 was entered. Using that standard, the current Application reflects no reduction in NO_X emissions.

Q. In Order No. 754, the Council found that A[s]mog levels that pose potential risks to health occur in the Fraser Valley about 43 percent of the time for ground-level ozone@ pollution. Order No. 754 at 50 (Finding of Fact No. 38). What is the expected effect of the proposed changes on ground-level ozone in the region?

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

A. If there are no daytime start-ups, there would be a small reduction. The reduction probably would not result from the elimination of diesel so much as it would from the higher stack.

The peak seasons for ground-level ozone are summer, spring and fall. Thus, the modeling has been conducted for a representative summertime smog event. See Exhibit 25.3. The elimination of backup oil, which the Applicant argued would have been used mainly during the winter months, has no effect on the predicted ozone levels during the prime smog seasons, spring through fall. The proposed increase in stack height may provide a small decrease in the predicted ozone impacts (but no more than about 10%).

If start-ups were to occur in the daytime during smog events, they could lead to a significant increase in the predicted maximum 1-hour ozone concentrations. This would more than negate the effect of the higher stack.

Q. In Order 754, the Council found that pollutants from the plant Awould cause a perceptible change in visibility for at least several days per year. There would be a diminution [in] visibility at least two days a year in the Olympic National Park which is approximately 100 miles from the proposed project.@ Order No. 754 at 50 (Finding of Fact No. 39). What is the effect of the changes in the proposed project on regional haze and visibility?

A. The potential for visibility impacts in the Abbotsford area has been reduced by only a small amount, despite the elimination of backup oil firing. As part of the previous application, analyses were conducted for several sight-lines in the Abbotsford area. The results were presented in the Lower Fraser Valley Air Quality Coordinating Committee report of September, 2000. In the absence of oil firing, it was predicted that a perceptible reduction in visibility would occur on up to 14 days/year. Changes to the proposed power plant in the current application do not affect these predictions.

Oil firing was expected to contribute only a few additional days/year of reduced visibility. Oil firing was expected to occur on only 10 days/year (maximum rolling average), of which no more than about 25% would be days when visibility is noticeably affected. This contribution from oil firing has been eliminated in the Second Revised Application, but now SO_2 emissions are higher when burning gas, which will partially offset the small gain achieved by eliminating oil firing.

Q: Do you believe the modeling results provide an accurate assessment of visibility impacts?

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

A: No. Like all modeling, the modeling procedure used in this analysis is approximate. In the present case, it has some shortcomings that would lead to an underestimation of the impact of the S2GF on visibility in the Abbotsford area.

- The predicted wind speeds used in the modeling were about 30% higher than actual wind speeds in the Abbotsford area. This leads to a commensurate underestimation of pollutant concentrations and their impact on visibility in that area.

- The CALPUFF model used in this analysis represents a simplified treatment of visibility and haze. It does not account for the effect of secondary organic aerosol formed as a byproduct of VOC emissions and does not account for the effect of gaseous pollutants, NO_2 in particular, which may lead to a modest underestimation of the impact on visibility. It also does not fully account for the contribution to particulate matter made by NH_3 emissions.

In addition to the above, assumptions about the chemical make-up of the particulate matter emitted by the S2GF introduce additional uncertainty to the results.

Q: Regarding particulate matter, in Order No. 754, the Council found that the Lower Fraser Valley airshed is under active air quality management by British Columbia agencies because it is already prone to periods of poor air quality due to, among other things, inhalable particulates; that current particulate matter concentrations in the Valley exceed Canadian 24-hour criteria up to four days per year; and that the facility=s particulate emissions would Aadd to the background concentrations and further narrow the present small margin of safety between an acceptable ambient air quality and the level at which association between level of particulate matter and increased health risks occurred.@ Pre-Hearing Order at 24, 25, 26-27. What are the implications of the proposed modifications as they relate to the Council=s findings about particulate matter?

A. The changes and related analyses provide no basis for concluding that there should be any change to the Council=s previous conclusions. The Second Revised Application and the Applicant=s Pre-Filed Testimony do not provide sufficient information to warrant a change in the Council=s conclusions. One problem with the Applicant=s materials (and I have already mentioned this in another context) is the failure of the Applicant to consider the higher NO_X and VOC emissions during start-up and shut-down. Those higher emissions can contribute to particulate matter and must be factored into a proper analysis.

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

Another weakness of the analysis is that is does not fully consider the secondary formation of particulate matter. The basic problem is that the predicted values shown in Section 6.1 of the current EFSEC application do not account for all of the PM-10 and PM-2.5 that will be present in the plume. The modeling accounted for the portion of the particulate matter that is emitted directly from the stacks, but did not account for particulate matter that is formed in the outside air as a byproduct of chemical reactions among other pollutants. Emissions of NO_X, SO_2, VOC=s and NH_3 can all contribute to so-called Asecondary@ particulate matter.

Eric Hansen, in his pre-filed testimony, acknowledges this deficiency in the Second Revised Application but only provides a partial correction. Hansen uses a different model (the CALPUFF model) and generates predictions of particulate matter that are 50 percent higher than those presented in Section 6.1 of the Second Revised Application. Hansen explains that his higher results are because the CALPUFF model accounts for some of the secondary particulate matter formation. While accounting for Asome@ of the secondary particulate matter formation is a step in the right direction, CALPUFF still falls short, as mentioned previously. Without an analysis that fully considers secondary particulate formation, it is impossible to make a substantiated claim about the revised project=s impact on the A present small margin of safety@ in particulate levels that is of concern to the Council.

Moreover, as previously noted, the CALPUFF modeling had the additional shortcoming of overestimating wind speeds in the Abbotsford area, which would lead to an underestimate of maximum ground-level concentrations. Taking these factors, into consideration, the overall concentration of particulate matter could be significantly more than suggested by Mr. Hansen.

Q: In Order No. 754, the Council found that the ACanadian portion of the Lower Fraser Valley would receive much of the potentially harmful air emissions from the proposed power plant.@ What are the implications of the current modifications to that finding?

A: None of the changes in the Second Revised Application would cause any change in that conclusion. The only change that would remotely have the potential to affect that finding would be the change in the stack height. But in terms of regional dispersion, there is no significant difference between the emissions occurring 150 feet above the ground versus 180 feet above the ground. Either way, the Canadian portion of the Lower Fraser Valley would receive much of the potentially harmful air emissions from the proposed power plant.

Q: In Order No. 754, the Council found that Athe Lower Fraser Valley in Canada is

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868

a confined airshed where mountains act to confine the air mass and the topographic features exacerbate the retention of pollutants.@ Order No. 754 at 51 (Finding of Fact 42). Do any of the project changes or new information in the Second Revised Application impact that finding?

A: The most obvious change that might have had an impact that way would be a change of location. That is, if the modification of the project were a new site in an area with more favorable air quality conditions. None of the modifications proposed in the Second Revised Application have any impact on the fundamental problem identified in Order No. 754 that this polluted, confined, highly populated, and rapidly growing area is not an appropriate site in which to locate a power plant.

END OF TESTIMONY

bc\lepage-pft-100101

BRICKLIN & GENDLER, LLP
ATTORNEYS-AT-LAW
SUITE 1015 FOURTH AND PIKE BUILDING
1424 FOURTH AVENUE
SEATTLE, WA 98101
(206) 621-8868